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Risk factors on incidence of tuberculosis in Tinambung, Indonesia

Factores de riesgo en la incidencia de la tuberculosis en Tinambung, Indonesia

Basrun Anccunk[1a], Arsunan Arsin[2b], Ridwan Amiruddin[3b], A. Zulkifli Abdullah[4c], Suriah[5c], Apik Indarty Moedjiono[6d]

SUMMARY

Tuberculosis increases as TB-HIV cases increase; it is caused by knowledge, unhealthy behavior, increasing poverty, TB drug resistance, and to sociodemographic and environmental problems. This study aimed to analyse individual and environmental risk factors for the incidence of tuberculosis.

This type of research is an observational analysis of a population of the Tinambung community using a case-control study design carried out in the working area of the Tinambung Health Center. With a sample of 156 people (76 cases and 76 controls), the instruments used were questionnaires and lighting and humidity measurements. Cases are tuberculosis sufferers, and controls are non-tuberculosis sufferers. Odds ratio data analysis and logistic regression were used to analyze potential risk factors for the incidence of tuberculosis using an α of 5 %.

The results showed that the significant risk factors for the incidence of tuberculosis were knowledge (OR= 2.562, Cl95 %: 1.344-4.884, p: 0.004), nutritional status (OR= 19.159, Cl95 %: 7.744-47.397, p: 0.0001), habit smoking (OR= 6.800, Cl95 %: 3.060-15.111, p: 0.0001), contact history (OR= 11.324, Cl95 %: 1.413-90.761, p: 0.005), lighting (OR= 4.784, Cl95 %: 1.925-11.892, p:0.0001), and occupancy density (OR= 3.364, Cl95 %: 1.034-10.938, p:0.035). The conclusion is that knowledge, nutritional status, smoking, contact history, lighting, and occupancy density are risk factors for tuberculosis. Nutritional status is the most influential factor in the incidence of tuberculosis. It is recommended that efforts to improve nutrition in the community be increased and screening of TB household contacts as early as possible.

Keywords: *Nutritional status, smoking, contact history, lighting, occupational density, tuberculosis.*

RESUMEN

La tuberculosis aumenta a medida que aumentan los casos de TB-VIH; a causan los conocimientos, los comportamientos poco saludables, el aumento de la pobreza y la resistencia a los fármacos antituberculosos

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ORCID: 0009-0001-4838-6622[1]
ORCID: 0000-0003-3311-6686[2]
ORCID: 0000-0002-0235-4211[3]
ORCID: 0000-0003-4437-6811[4]
ORCID: 0000-0002-2239-0017[5]
ORCID: 0000-0002-2740-9506[6]

[a]Master's Programme, Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Indonesia.

[b]Department of Epidemiology, Faculty of Public Health, Hasanuddin University, Indonesia.
[c]Department of Health Promotion, Faculty of Public Health, Hasanuddin University, Indonesia.
[d]Department of Biostatistics, Faculty of Public Health, Hasanuddin University, Indonesia.
E-mail: basrunepid@gmail.com

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y a problemas sociodemográficos y ambientales. Este estudio pretende analizar los factores de riesgo individuales y ambientales en la incidencia de la tuberculosis.

Se trata de un análisis observacional de una población de la comunidad de Tinambung mediante un diseño de estudio de casos y controles realizado en el área de trabajo del Centro de Salud de Tinambung. Con una muestra de 156 personas (76 casos y 76 controles), los instrumentos utilizados fueron cuestionarios y mediciones de iluminación y humedad. Los casos son tuberculosos y los controles no tuberculosos. Se utilizaron el análisis de datos de odds ratio y la regresión logística para analizar los posibles factores de riesgo de la incidencia de tuberculosis utilizando un α del 5 %.

Los resultados mostraron que los factores de riesgo significativos para la incidencia de tuberculosis eran el conocimiento (OR= 2,562, Cl95 %: 1,344-4,884, p: 0,004), el estado nutricional (OR= 19,159, Cl95 %: 7,744-47,397, p: 0,0001), el hábito de fumar (OR= 6. 800, Cl95 %: 3,060-15,111, p: 0,0001), historial de contactos (OR= 11,324, Cl95 %: 1,413-90,761, p: 0,005), iluminación (OR= 4,784, Cl95 %: 1,925-11,892, p:0,0001) y densidad de ocupación (OR= 3,364, Cl95 %: 1,034-10,938, p:0,035). La conclusión es que los conocimientos, el estado nutricional, el tabaquismo, los antecedentes de contacto, la iluminación y la densidad de ocupación son factores de riesgo de tuberculosis. El estado nutricional es el factor que más influye en la incidencia de la tuberculosis. Se recomienda redoblar los esfuerzos para mejorar la nutrición en la comunidad y someter a cribado a los contactos domésticos con tuberculosis lo antes posible.

Palabras clave: *Estado nutricional, tabaquismo, historial de contactos, iluminación, densidad ocupacional, tuberculosis.*

INTRODUCTION

Tuberculosis is one of the world's top 10 causes of death caused by *Mycobacterium tuberculosis*. This is one of the Sustainable Development Goals (SDGs) to become a public health issue in Indonesia and internationally (1). Tuberculosis is an infectious disease which is still a world concern because the morbidity and mortality are still very high (2).

Indonesia is ranked second in the world with tuberculosis sufferers after India; tuberculosis cases have decreased but have not reached the target of the END TB strategy, since only decreased by 9 % (3). The death rate from TB has decreased but did not reach the target of half the target set (3). Of the three provinces, West Java, East Java, and Central Java already represent half of the tuberculosis cases in Indonesia (4).

TB is an environment-based disease. The condition of the home environment plays a significant role in the transmission of tuberculosis (5). The risk factors for TB transmission are environmental factors and behavioral factors. Environmental factors include ventilation, occupancy density, temperature, lighting, and humidity. While behavioral factors include smoking habits, spitting or throwing phlegm anywhere, coughing or sneezing without covering your mouth, and the habit of not opening windows (6).

The occupancy density factor can increase the incidence of tuberculosis the higher the contact with tuberculosis patients who can be transmitted (7). Adequate lighting and humidity in the room can kill and inhibit microorganisms' growth, including tuberculosis germs (8). High humidity conditions facilitate the transmission of tuberculosis (9).

The situation of West Sulawesi Province regarding the incidence of tuberculosis from 6 districts are, the higher in Polewali Mandar district with a total of 511 cases, followed by Mamuju district with 395 cases, Majene district with 229 cases, Central Mamuju district with 165 cases, North Mamuju district with 127 cases and the lowest district Mamasa as many as 102 cases. (10).

The challenge for tuberculosis control efforts in West Sulawesi is about public awareness of healthy living and prevention of tuberculosis to increase the risk of spreading infection (10).

In Polewali Mandar Regency, tuberculosis is a significant public health problem. The number of TB patients in Polewali Mandar district is 540 new cases smear-positive; of the total number of tuberculosis sufferers, 70 % are of productive age. In 2021, tuberculosis sufferers were found during this pandemic reaching 772 cases (11). This study aimed to analyze individual and environmental risk factors for the incidence of tuberculosis.

MATERIALS AND METHODS

Research Design and Location

This research uses quantitative methods using observational analytic studies with a case-control study approach. Will be carried out in the working area of the Tinimbung Public Health Center, Polewali Mandar Regency.

Population and Research Sample

The population in this study is those in the district of Tinambung. Samples were taken from the SITB application with a total of 78 cases. The sample size uses a 1:1 ratio of cases and controls, the case sample is 78, and the control sample is 78, the total sample is 156 people. The sampling technique uses the purposive sampling method.

Instruments and Procedures

The data was collected using a questionnare through interviews and observations of lighting and humidity measurements. Measurement of lighting using a lux meter and humidity using a hygrometer. Both tools were placed in the middle of the respondent's room for 10-15 minutes.

This research has received ethical approval from the Faculty of Public Health, Hasanuddin University, with number: 10253.UN4.14.1/ TP.01.02/2022 on September 5, 2022. Furthermore, has been granted a research permit for Polewali Mandar Regency with number: 503/0632/IPL/DPMPTSP /IX/2022.

Data analysis

Data processing and analysis were carried out using the SPSS version 25 program. Univariate analysis was carried out to describe or describe the research variables presented in the frequency distribution of each variable. The bivariate analysis uses two stages. The first stage uses the Chi-Square test to determine the relationship between the independent and dependent variables. The second stage uses the odds ratio (OR) to determine the risk of the independent variable to the dependent variable. Multivariate analysis was used to establish the relationship and magnitude of the relationship between the independent variables jointly with the dependent variable. The analysis used is logistic regression analysis.

RESULTS

The characteristics of the research subjects are shown in Table 1; three characteristics are compared, gender, age, and address. The results of the analysis showed that the respondents who were matched in the age group 55-59 years were 24 people (15.38 %), 12 cases and controls each, while in the age group 75 years and over were four people (2.56 %), each case and control two people. For gender, most of the respondents were male, with 93 respondents (59.62 %), while female were 63 respondents (40.38 %). For the characteristics of the address, more respondents live in Karama village, 44 respondents (28.21 %) in each case, and control 22 respondents (28.21 %).

For the level of education, the most research results with high school graduation education were 66 people (45.51 %). In the case group, most respondents were at the level of elementary school graduate education, with 30 respondents (38.46 %), while in the control group, most were at the equivalent high school education level, with 37 respondents (47.44 %).

For employment, most are working as a housewife, with 39 respondents (25 %). In the case group, 20 respondents (25.64 %) worked as housewives, while the control group mostly worked as housewives, with 19 respondents (24.36 %).

The results of the bivariate analysis can be seen in Table 2. It shows that the p-value results for all variables are below 0.05, so all variables have a significant relationship. Based on the odds ratio (OR) test, the variables that are risk factors for the incidence of tuberculosis are knowledge, nutritional status, smoking, contact history, lighting, and occupancy density. While the humidity variable is related but based on the OR value, the lower limit and upper limit values

Table 1. Distribution of Research Respondents' Characteristics in the Working Area of the Tinambung Health Center Polewali Mandar Regency

	Characteristics of Respondents	Case		Control		Total	%
		n	%	n	%		
1	**Age**						
	15-19 Years	6	7.69	6	7.69	12	7.69
	20-24 Years	9	11.54	9	11.54	18	11.54
	25-29 Years	6	7.69	6	7.69	12	7.69
	30-34 Years	3	3.85	3	3.85	6	3.85
	35-39 Years	6	7.69	6	7.69	12	7.69
	40-44 Years	2	2.56	2	2.56	4	2.56
	45-49 Years	7	8.97	7	8.97	14	8.97
	50-54 Years	7	8.97	7	8.97	14	8.97
	55-59 Years	12	15.38	12	15.38	24	15.38
	60-64 Years	9	11.54	9	11.54	18	11.54
	65-69 Years	6	7.69	6	7.69	12	7.69
	70-74 Years	3	3.85	3	3.85	6	3.85
	75+ Years	2	2.56	2	2.56	4	2.56
2	**Sex**						
	Male	47	60.26	46	58.97	93	59.62
	Female	31	39.74	32	41.03	63	40.38
3	**Address**						
	Tinambung	13	16.67	13	16.67	26	16.67
	Batulaya	7	8.97	7	8.97	14	8.97
	Karama	22	28.21	22	28.21	44	28.21
	Tangnga-tangnga	13	16.67	13	16.67	26	16.67
	Lekopadis	7	8.97	7	8.97	14	8.97
	Sepabatu	9	11.54	9	11.54	18	11.54
	Tandung	4	5.13	4	5.13	8	5.13
	Galung Lombok	3	3.85	3	3.85	6	3.85
4	**Education**						
	No School	0	0.00	3	3.85	3	1.92
	Not Graduated from Elementary School	4	5.13	0	0.00	4	2.56
	Has Graduated from Elementary School	30	38.46	23	29.49	53	33.97
	Junior High School	11	14.10	6	7.69	17	10.90
	Senior High School	29	37.18	37	47.44	66	42.31
	Akademi/PT	4	5.13	9	11.54	13	8.33
5	**Occupation**						
	Jobless	3	3.85	3	3.85	6	3.85
	PNS/TNI/Polri/PPPK	3	3.85	5	6.41	8	5.13
	Private Sector Employee	1	1.28	0	0.00	1	0.64
	Self-employed/trader	19	24.36	10	12.82	29	18.59
	Farmer	5	6.41	10	12.82	15	9.62
	Fisherman	14	17.95	13	16.67	27	17.31
	Honorary employee	1	1.28	1	1.28	2	1.28
	Laborer	3	3.85	5	6.41	8	5.13
	Motorcycle taxi driver	0	0.00	1	1.28	1	0.64
	Students	9	11.54	9	11.54	18	11.54
	Retired	0	0.00	2	2.56	2	1.28
	Housewife	20	25.64	19	24.36	39	25.00

Source: Data Primer, 2022.

Table 2. Distribution of the Risk of Independent Variables on the Incidence of Tuberculosis in the Tinambung Health Center Working Area, Polewali Mandar Regency

Research Variables	Case		Control		p	OR	Cl 95%
	n	%	n	%			
Knowledge							
Less	47	60.26	29	37.18	0.004	2.562	1.344-4.884
Good	31	39.74	49	62.82			
Nutritional Status							
Less	51	65.38	7	8.97	0.0001	19.159	7.744-47.397
Good	27	34.62	71	91.03			
Smoking							
Smoking	39	50.00	10	12.82	0.0001	6.800	3.060-15.111
No Smoking	39	50.00	68	87.18			
Contact History							
Had Contact	10	12.82	1	1.28	0.005	11.324	1.413-90.761
No Contact	68	87.18	77	98.72			
Lighting							
Not Qualified	25	32.05	7	8.97	0.0001	4.784	1.925-11.892
Meets Requirements	53	67.95	71	91.03			
Humidity							
Not Qualified	75	96.15	68	87.18	0.043	3.676	0.971-13.919
Meets Requirements	3	3.85	10	12.82			
Residential Density							
Dense	12	15.38	4	5.13	0.035	3.364	1.034-10.938
Not dense	66	84.62	74	94.87			

Source: Data Primer, 2022.

include a value of 1; humidity is a risk factor that is not significant and is not a risk factor for tuberculosis.

The results of step 1 multivariate analysis showed that of the seven variables that were significant to the incidence of tuberculosis, it was found that there were 4 of the most influential variables. The first most influential variable was the nutritional status with OR = 30,360 (Cl95 %: 9,517-96,848). The second, contact history variables OR=20,461 (Cl95 %: 1,849-225,064). The third, smoking variables with OR= 15,084 (Cl95 %: 4,752-47,881), and the fourth, lighting variables with OR=7,078 (Cl95 %: 1,849-27,085) (Table 3).

Table 3. Results of Multivariate Analysis of Risk Factors for Tuberculosis Incidence in the Tinambung Health Center Working Area, Polewali Mandar Regency

Variabel Penelitian	B	Waid	Sig.	Exp(B)/OR	95% C.I.for EXP(B)	
					Lower	Upper
Step 1						
Knowledge	0.398	0.638	0.424	1.489	0.561	3.953
Nutritional Status	3.413	33.257	0.0001	30.360	9.517	96.848
Smoking	2.714	21.200	0.0001	15.084	4.752	47.881
Contact History	3.019	6.087	0.014	20.461	1.860	225.064
Lighting	1.957	8.168	0.004	7.078	1.849	27.085
Occupancy Density	1.153	1.621	0.203	3.167	0.537	18.683
Constant	-9.870	25.501	0.0001	0.0001		

Source: Data Primer, 2022.

DISCUSSION

The results showed that there was a relationship between knowledge and a risk factor with the incidence of tuberculosis in the working area of the Tinambung Public Health Center, Polewali Mandar Regency. The research from Zhulaikha indicate that knowledge is a risk factor for tuberculosis in the working area of the Bandarharjo Semarang Health Center (8) and the research conducted in Pulogadung Jakarta found that there is a relationship between knowledge and the occurrence of tuberculosis (12). Madjid et al. showed that the level of public understanding of tuberculosis could prevent tuberculosis (13). Likewise, Madjid et al. showed that high public knowledge about tuberculosis could influence attitudes toward tuberculosis prevention (14). By increasing public understanding, people can change their behaviour to prevent tuberculosis (15).

The results showed that there was no relationship between poor nutritional status and a risk factor for tuberculosis. According to the theory that nutritional status is a variable that plays a very important role in the incidence of tuberculosis; of course, this still depends on other variables, the main of which is the presence or absence of tuberculosis germs in the body and attacks the lungs. Because poor nutritional status will interfere with the immune system, which facilitates the occurrence of infectious diseases, including tuberculosis, it is necessary to maintain (6).

The results of this study are in line with several previous studies, including the study of Dhanaraj et al., which found that BMI <18.5 was a factor associated with the incidence of tuberculosis in adults in metropolitan cities of South India (16), Dhanaraj et al. and Mathew et al. found that among health workers, low BMI was a risk factor for contracting tuberculosis (17). Sekar Prihanti et al., using a case-control study, showed that low BMI is a risk factor for tuberculosis (6), and Prambang and Setiawan using a meta-analysis shows that BMI results are a risk factor for tuberculosis (7).

The results on smoking on the incidence of tuberculosis have a relationship and are risk factors. Smoking habits are a very important risk factor for pulmonary TB because there are carcinogenic substances contained in cigarette smoke which generally consist of contaminants in the form of carbon monoxide and particulates (18). Smoking can cause changes in the structure and function of the airways and lung tissue. In lung tissue, there is an increase in the number of inflammatory cells and damage to the alveoli (19).

In general, several studies are in line with the results of this study, including a case-control study in Croatia by Anamarija Jurcev et al., who found that former smokers and smokers were significantly associated with the incidence of pulmonary TB, even passive exposure to cigarette smoke in non-smokers (passive smokers) in a bivariate analysis was also associated with pulmonary TB because they are exposed to inhaling toxic substances that are similar to active smokers, although in different concentrations (20).

Another variable was found to have a very strong relationship and was a risk factor for pulmonary tuberculosis in adults in the working area of the Tinmbung Public Health Center, Polewali Mandar Regency, namely, household contact history of TB. The results of this study indicate that people who have had contact in the past live in the same house or are in contact while working with people with pulmonary tuberculosis have an 11.3-fold risk of getting positive pulmonary tuberculosis than people who have never had contact with tuberculosis at home or work. These results are consistent with the theory that there is a history of contact with family members who live in the house and ≥ three months of contact are at risk of developing pulmonary tuberculosis, especially through contact (21).

Several studies are in line with the results of this study. Among them, a case-control study, in Croatia, by Jurcev-Savicevic et al., who found that people with a history of contact with TB were 2.19 times more likely to suffer from pulmonary TB (20). Likewise, Ruswanti B's research in Kab. Pekalongan, Indonesia, shows that family members who have contact with pulmonary TB sufferers are at risk of contracting pulmonary TB as much as 4.5 times greater than family members who have no contact (22). A case-control study of healthcare workers in South India conducted

by Mathew et al. found that health workers who have frequent contact with TB patients have a 2.83 times higher risk of contracting pulmonary TB (17).

The results of the lighting study showed that there was a significant relationship and was a risk factor for the incidence of tuberculosis. Kills bacteria, especially *Mycobacterium tuberculosis*. Tuberculosis germs can only be killed by direct sunlight (23). This research is in line with Sahadewa and Luh, who examined Jatikalang village, Krian sub-district, Sidoarjo district using a case-control study showing that lighting is a risk factor for tuberculosis (24).

Variable humidity, shows that there is a relationship, but it is not a risk factor for tuberculosis. This is not in line with Sahadewa and Luh, which was conducted in Krian District, Sidoarjo Regency, which showed that there was a significant relationship between humidity and the incidence of tuberculosis (24). This research is also in line with Fahdhienie Farrah et al., conducted at the Pidie Health Center, Pidie District, which proved that humidity levels that did not meet the requirements had a 4.26 times greater risk of having respondents exposed to tuberculosis compared to humidity levels that met the requirements (2). This is because the settlements occupied are almost the same and are influenced by weather factors.

The results of the occupancy density variable showed that it had a relationship and was a risk factor for tuberculosis. Based on the theory of occupancy, density plays an important role and the process of environmental factors in the transmission of tuberculosis (25). Population density and residential density are environmental influences that are quite strong in the transmission of infectious diseases (26).

The results of this study are in line with the research of Mawardi & Indah, in which the results showed that occupancy density is at risk for the incidence of tuberculosis using case-control. Research by Sekar Prihanti et al. used a case-control study that occupancy density is a risk factor for tuberculosis (6). Fahdhienie Farrah et al., showed at the Pidie Community Health Center, Pidie District, that occupancy density is a risk factor for tuberculosis (2).

Multivariate analysis found that of the six variables, which were risk factors, there were four significant variables, namely nutritional status, smoking, contact history, and lighting, which had a strong influence on the incidence of tuberculosis. The nutritional status variable has a very strong influence on the incidence of tuberculosis but is still influenced by other variables such as contact history or exposure to TB germs.

CONCLUSION

Significant risk factors for the incidence of tuberculosis are knowledge, nutritional status, smoking, contact history, lighting, and occupancy density. The most influential risk factors are nutritional status and contact history.

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